6.7 LARGE-SCALE COOLING FACILITIES

6.7.1 Introduction

The purpose of cooling tower operation is to cool water that has absorbed the heat load of a heat-generating process. Cooling towers are present at a variety of commercial, industrial, and institutional facilities. Most large-scale cooling users are served by municipal water providers. These facilities are termed "individual users." Water providers are responsible for the individual users' compliance with industrial conservation requirements unless they have notified the Department of the existence of the individual user, in which case the individual user is responsible for compliance (see Chapter 5, section 5-112). Large-scale cooling users served by their own wells are regulated directly by the Department and are responsible for complying with industrial conservation requirements.

6.7.2 Water Use by Large-Scale Cooling Facilities

The main use of water in a cooling tower is to absorb heat from a heat-generating process and dissipate this heat through evaporation. Because a portion of the recirculating water is lost through evaporation, this is considered an "open" recirculating cooling loop.

The equipment served by a cooling tower varies from industry to industry, the most common is equipment used to reject heat from a large heating, ventilation, and air conditioning system (known as an HVAC system). Various equipment configurations are used to transfer heat from its source to the cooled water stream coming from the cooling tower. This transfer typically occurs inside a heat exchanger.

As a portion of cooling tower water evaporates, dissolved minerals become concentrated in the remaining water. Such problems as corrosion, mineral deposition, and biological fouling can result. These conditions reduce cooling efficiency and damage equipment. Chemical treatments including biocides, scale inhibitors, corrosion inhibitors, and addition of sulfuric acid can prolong the time mineral-laden water can safely be recirculated in towers. Mineral-laden water must periodically be discharged to prevent the excessive buildup of minerals and possible precipitation of these minerals onto equipment surfaces. This discharge is known as "blowdown." Replacement water, known as "make-up water," is added back to the tower's recirculating water stream to replace the water lost to evaporation and blowdown.

The "cycles of concentration," or "concentration ratio," achieved in a tower indicate how efficiently water is being used in the tower. Cycles of concentration can be determined by dividing the concentration of a constituent in the blowdown water by the concentration of this same constituent in the make-up water. The concentration of total dissolved solids, a measure of the overall dissolved mineral content in water, is one commonly used constituent for calculating the cycles of concentration.

6.7.3 Large-Scale Cooling Facility Program

Large-scale cooling facilities are defined as facilities with an aggregate cooling capacity of 1,000 tons or more. The following conservation requirements apply to cooling towers that are located at large-scale cooling facilities and that have 250 tons or more of cooling capacity.

- Fully operational towers with 250 tons or more of cooling capacity must achieve either 120 mg/l of silica or 1,200 mg/l of total hardness in recirculating water, whichever is reached first, before blowing down.

- If needed, a facility may apply for an alternative blowdown standard for any tower using treated effluent. During the initial 12-month period during which 50 percent or more of the water used by a tower is effluent, the tower is exempt from blowdown standards.

- If needed, a facility may apply for an alternative blowdown standard for any tower if compliance with blowdown requirements would likely result in damage or exceedence of environmental discharge standards because of the accumulation of a limiting constituent other than silica or total hardness.

- Facilities must record monthly and report annually the volumes of tower make-up water and blowdown water and the concentrations of silica and total hardness or approved alternative constituent in both make-up water and blowdown water.

6.7.4 Future Directions

Currently, the Department is not aware of any large-scale cooling facilities in the Pinal AMA, nor is it aware of any plans to construct such facilities within the AMA during the third management period.

6.7.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Large-Scale Cooling Facilities

6-701. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. *"Blowdown water" means water discharged from a cooling tower recirculating water stream to control the buildup of minerals or other impurities in the recirculating water.*

2. *"Conservative mineral constituent" means a component of recirculating water in a cooling tower, the concentration of which is not significantly modified by precipitation, loss to the atmosphere, or the addition of treatment chemicals.*

3. *"Cycles of concentration" means the ratio of the concentration of a conservative mineral constituent or electrical conductivity in the blowdown water to the concentration of this same constituent or electrical conductivity in the make-up water.*

4. *"Effluent-served cooling tower"means a cooling tower served by a make-up water supply which on an annual average basis consists of 50 percent or more effluent.*

5. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat.*

6. *"Large-scale cooling facility" means a facility which has control over cooling operations with a total combined cooling capacity greater than or equal to 1,000 tons. For the purposes of this definition, the minimum cooling tower size which shall be used to determine total facility cooling capacity is 250 tons. A large-scale cooling facility does not include a large-scale power plant that utilizes cooling towers to dissipate heat.*

7. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity.*

8. *"Limiting constituent" means a chemical, physical, or biological constituent present in recirculating cooling tower water which, due to potential physical or biological factors or due to potential exceedence of any federal, state, or local environmental standards upon discharge as blowdown, should not be allowed to accumulate in recirculating cooling tower water above a certain concentration.*

9. *"Make-up water" means the water added back into the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

6-702. Conservation Requirements

A. Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation

requirement in the Fourth Management Plan, an industrial user who uses water at a large-scale cooling facility shall comply with the following requirement:

Each fully operational cooling tower with greater than or equal to 250 tons of cooling capacity at the facility shall achieve a cycles of concentration level that results in blowdown water being discharged at an average annual minimum of either 120 mg/l silica or 1,200 mg/l total hardness, whichever is reached first.

B. Exemptions and Alternative Blowdown Standards

1. *The requirement set forth in subsection A of this section, does not apply to a large-scale cooling facility in any year in which 100 percent of facility blowdown water is beneficially reused.*

2. *The requirement set forth in subsection A of this section does not apply to any effluent-served cooling tower at a large-scale cooling facility during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is effluent. After the 12-month period expires, the person using water at an effluent-served cooling tower may apply to the director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would not be possible due to the presence of a limiting constituent other than silica or total hardness in the effluent supplying the cooling tower. To apply for an alternative blowdown level to address such a limiting constituent, an industrial user shall submit a request in writing to the director which includes the following information:*

   a. *The limiting constituent other than silica or total hardness that is present in the effluent supplying the tower which results in the need to blow down a greater annual volume of water than that required under subsection A of this section.*

   b. *Documentation describing the concentration at which this limiting constituent should be blown down, and the reason for the alternative blowdown level.*

   The director shall grant the request if the director determines that the presence of a limiting constituent other than silica or total hardness in the effluent supplying the cooling tower results in the need to blow down a greater annual volume of water than that required under subsection A of this section. Any alternative blowdown level granted pursuant to this paragraph shall apply only while the tower qualifies as an effluent-served tower.

3. *An industrial user may apply to the director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would likely result in damage to cooling towers or associated equipment or exceedence of federal, state or local environmental discharge standards because of the accumulation of a limiting constituent other than silica of total hardness in recirculating water. To apply for an alternative blowdown level for such a limiting constituent, an industrial user shall submit a request in writing to the director which includes the following information:*

   a. *Historic, current and projected water quality data for the relevant limiting constituent(s).*

b. Documentation describing the potential damage to cooling towers or associated equipment, or documentation of environmental standards that are likely to be exceeded, whichever applies.

The director shall grant the request if the director determines that compliance with the blowdown level set forth in subsection A of this section would likely result in damage to cooling towers or associated equipment or exceedence of federal, state, or local environmental discharge standards because of the accumulation of a limiting constituent other than silica or total hardness in recirculating water.

6-703. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a large-scale cooling facility shall include in its annual report required by A.R.S. § 45-632 the following information for all cooling towers with 250 tons or more of cooling capacity at the facility:

1. Capacity in tons of each cooling tower.

2. Number of days per month that each cooling tower was fully operational.

3. For each cooling tower that is exempt from cycles of concentration requirements or for which an alternative blowdown level has been granted pursuant to section 6-702, subsection B, paragraph 2, the percentage of water served to the tower during the year that was effluent.

4. The quantity of water from any source, specified by source, which was used for make-up water on a monthly basis during the calendar year as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

5. The quantity of water which was blown down on a monthly basis during the calendar year as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

6. The average monthly concentrations of silica, total hardness or other approved limiting constituent established under section 6-702 subsection B, paragraph 2 or 3, in make-up and blowdown water for those portions of each month when the cooling towers were fully operational during the calendar year, reported in mg/l or other measurement units established under section 6-702, subsection B, paragraph 3, and either:

a. Determined by direct analysis; or

b. Calculated based on average monthly electrical conductivity readings for the portions of each month when cooling towers were fully operational if the following conditions have been met: (a) correlations between electrical conductivity and silica, between electrical conductivity and total hardness, or between electrical conductivity and another approved limiting constituent established pursuant to section 6-702 subsection B, paragraph 2 or 3, have been established over a period of one year or more in make-up and blowdown water; and (b) documentation of these correlations has been provided to the director.